

## Scientific Method

From the dawn of time, humans have encountered the world they live in and continually questioned what they have experienced. In other words, people wondered why things were the way they were. By observing and experimenting, humans gradually learned more about the world around them. They developed many ideas about how and why things worked. Once they found an answer, they built upon the knowledge to make new and more complex discoveries. At one time, humans idly asked questions. As time went on, the way people asked and answered questions developed into a more methodical system. Eventually, what we know as science was developed.

Science generally refers to the field of study that seeks to expand knowledge about the physical world. There are many branches of science such as: astronomy, botany, geology, and zoology. These branches study more specific areas of the physical world. All branches, however, have common characteristics in that they use similar methods in order to find facts and answer questions. The method that scientists use is very important because it allows scientists to efficiently collect and process information. The information is then used as an explanation.

In the 6<sup>th</sup> century BCE, a man named Thales lived in what is now known as Turkey. He is often remembered as one of the first people on record to have tried to organize knowledge of the physical world. He studied the skies and saw the constellations of stars. He felt earthquakes and watched solar eclipses. Observing these things, he tried to come up with ideas as to why these things were the way they were. These first ideas are known as hypotheses.

The first action in scientific research is usually observation. Like Thales, a scientist notices and observes the world around him. For example, a scientist observes that plants sometimes flower, that owls hoot at nighttime, and that the sun changes its height in the sky throughout the year. The next step is usually creating a hypothesis. This is a key concept in science. A hypothesis is a reasonable idea why things are a certain way or happen a certain way. Most of the time, the hypothesis may not be completely true, but it guides the scientist's next step.

A book called "The Nature of Things" was written by Lucretius. He lived in Rome in the 1<sup>st</sup> century BCE, about 500 years after Thales. In his book, Lucretius discussed scientific observations and presented his hypotheses as to the reasons behind these things. He wrote: "*The velocity of thunderbolts is great and powerful, and they run their course with very fast speed. This is because they consist of small and smooth elements that easily pass through the air. These elements easily melt and fuse gold and brass when struck by a thunderbolt because the elements are moving so fast and are so small.*" In this case, Lucretius observed lightning in the sky and the damage it causes. He thought of the reason that lightning might be like this. His hypothesis was that lightning was full of very small particles.

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## Scientific Method (Cont'd)

However, just observing and coming up with a hypothesis is not enough for the scientific method to be successful. The next step a scientist needs to take is to find evidence that supports his hypothesis. Evidence helps prove or disprove a scientist's hypothesis. During this phase of the scientific method, the scientist often makes a model of his hypothesis or he takes samples of the subject in order to obtain data. Scientists often conduct experiments which test their hypotheses. In these tests, scientists look carefully to see if what they predict to happen will happen.

A good example of a scientist conducting an experiment is when Isaac Newton watched an apple fall from a tree branch and wondered why this occurred and whether or not this was true for all things everywhere. Observing this motion, he began conducting experiments which tested the falling of objects to the ground. He tested things from different heights and of different sizes. He found that all things fell because objects have a force between them called gravity, and gravity is the reason that objects fall to the earth.

These three parts of the scientific method are crucial to the development of knowledge about the world: observation, forming a hypothesis, and obtaining evidence. Observation, forming a hypothesis, and performing experiments help scientists learn more and make new important discoveries that benefit humankind. All scientists share the wonder of Thales as they observe various changes in the world, and all seek to find the reasons for these changes and the best way to do this is through the scientific method.

### Scientific Method Questions

**Matching:**

- \_\_\_ 1. Thales                      a. found that all things fell because objects have a force between them called gravity
- \_\_\_ 2. Lucretius                b. was one of the first people on record to have tried to organize knowledge of the physical world
- \_\_\_ 3. Isaac Newton            c. wrote a book called "The Nature of Things"

**True or False:**

- \_\_\_ 4. Thales lived in Rome in the 1<sup>st</sup> century BCE, about 500 years after Lucretius.
- \_\_\_ 5. Science generally refers to the field of study that seeks to expand knowledge about the physical world.
- \_\_\_ 6. A hypothesis is a reasonable idea why things are a certain way or happen a certain way.
- \_\_\_ 7. Most of the time, a hypothesis may not be completely true, but it guides the scientist's next step.

**8. List the 3 crucial parts of the scientific method:**

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**Multiple Choice:**

9. The following are all branches of science EXCEPT:
- a. astronomy
  - b. botany
  - c. observation
  - d. zoology

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## Scientific Method Answers

### Matching:

- b   1. Thales                      a. found that all things fell because objects have a force between them called gravity
- c   2. Lucretius                    b. was one of the first people on record to have tried to organize knowledge of the physical world
- a   3. Isaac Newton                c. wrote a book called "The Nature of Things"

### True or False:

- F   4. Thales lived in Rome in the 1<sup>st</sup> century BCE, about 500 years after Lucretius.
- T   5. Science generally refers to the field of study that seeks to expand knowledge about the physical world.
- T   6. A hypothesis is a reasonable idea why things are a certain way or happen a certain way.
- T   7. Most of the time, a hypothesis may not be completely true, but it guides the scientist's next step.

### 8. List the 3 crucial parts of the scientific method:

\_\_\_\_\_ observation \_\_\_\_\_

\_\_\_\_\_ forming a hypothesis \_\_\_\_\_

\_\_\_\_\_ obtaining evidence \_\_\_\_\_

### Multiple Choice:

9. The following are all branches of science EXCEPT:

- e. astronomy
- f. botany
- g. observation**
- h. zoology